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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/722,295 | 11/25/2003 | Young-Hun Seo | OPP 031051 US | 9100 |
| 36872 | 7590 | 07/03/2006 | EXAMINER | |
| THE LAW OFFICES OF ANDREW D. FORTNEY, PH.D., P.C. 401 W FALLBROOK AVE STE 204 FRESNO, CA 93711-5835 | | | CHEN, JACK S J | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2813 | |
| DATE MAILED: 07/03/2006 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|--------------------------------|--|
| Office Action Summary | Application No. 10/722,295 | Applicant(s) SEO, YOUNG-HUN | |
| | Examiner Jack Chen | Art Unit 2813 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

In response to the communication filed on May 22, 2006, claims 1-6 and 8-20 are active in this application.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 22, 2006 has been entered.

Specification

2. The amendment filed 9/16/05 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: Re claims 2, 4, 8, 10, 15 and 17 the phrase "or more" is not supported by the original specification. Re claims 3, 9 and 16, the phrase "comprises injecting at most 60sccm ...and at most 200sccm of Ar gas" is not supported by the original specification.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

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The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 2-4, 8-10 and 15-17 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Re claims 2, 4, 8, 10, 15 and 17 the phrase "or more" is not supported by the original specification. Re claims 3, 9 and 16, the phrase "comprises injecting at most 60sccm ...and at most 200sccm of Ar gas" is not supported by the original specification. The remaining claims 5, 11 and 18 are rejected for depending from the above rejected claims.

For the purposes of patentability, these claims will be interpreted as best understood.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-6 and 8-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moore et al., U.S./6,884,725 B2 in view of Bamnolker et al., U.S./6,890,859 B1.

Moore et al. (Figs. 12-14) discloses a method of forming a trench in a semiconductor device, which comprises forming a polish stop layer 72 (fig. 12) on a semiconductor substrate 12; forming an anti-reflection coating 70 (fig. 12) on the polish stop layer [note: silicon

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oxynitride is inherently an anti-reflection coating, see U.S./6,884,733 B1, claim 2 as evidence]; selectively etching the anti-reflection coating to form an anti-reflection coating pattern (fig. 13); etching the polish stop layer and etching the semiconductor substrate to a predetermined depth to form a trench 20 such that ends of the polish stop layer adjacent to the trench are rounded (fig. 14) and the trench have sloped sidewalls (i.e., the top corner of the trench 20); and forming an insulation layer 28 (fig. 6) that fills the trench, see figs. 1-14 and cols. 1-8 for more detail.

Moore et al. (figs. 10-11) also discloses a method of forming a trench in a semiconductor device, which comprises forming a polish stop layer 16a (fig. 10, in this case, the lower portion of the layer 16a is considered as the polish stop layer, i.e., 4/5 of layer 16a) or 16b (fig. 11, in this case, the lower portion of the layer 16b is considered as the polish stop layer, i.e., 9/10 of layer 16b) on a semiconductor substrate 12; forming an anti-reflection coating 16a (fig. 10, in this case, the upper portion of the layer 16a is considered as the anti-reflection coating, i.e., 1/5 of layer 16a) or 16b (fig. 11, in this case, the upper portion of the layer 16b is considered as the anti-reflection coating, i.e., 1/10 of layer 16b) on the polish stop layer [note: silicon nitride is inherently an anti-reflection coating, see U.S./6,884,733 B1, claim 2 as evidence]; selectively etching the anti-reflection coating to form an anti-reflection coating pattern (figs. 10 or 11); etching the polish stop layer and etching the semiconductor substrate to a predetermined depth to form a trench 20 such that ends 50 (fig. 10) or 60 (fig. 11) of the polish stop layer adjacent to the trench are rounded and the trench has sloped sidewalls (i.e., the top corner of the trench); and forming an insulation layer 28 (fig. 6) that fills the trench, see figs. 1-14 and cols. 1-8 for more detail.

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Re claims 2, 8 and 15, wherein etching is performed such that following the injection of one of argon, CF₄, CHF₃, plasma is created and dry etching is performed (col. 4, line 47 to col. 5, line 51).

Re claims 3, 9 and 16, wherein the etching is performed by injecting one of at most 60sccm of CHF₃ gas, at most 60sccm of CF₄ gas, at most 30sccm of O₂ gas, at most 60sccm of HeO₂ gas, and at most 200sccm of Ar gas (i.e. using 10-100 sccm argon, col. 4, lines 50-52).

Re claims 4, 10 and 17, wherein 50-500W of power is applied to generate plasma in a state where one of CHF₃, CF₄, O₂, HeO₂, and Ar is injected (i.e., using Ar at about 200 W; see col. 4, lines 47-60).

Re claim 6, wherein an area of the polish stop layer exposed through the antireflection coating pattern is etched to form the trench (figs. 10-14), and ends of the anti-reflection coating pattern are also etched such that the ends of the anti-reflection coating are rounded (figs. 10, 11 and 14).

Re claims 12 and 14 wherein the polish stop layer 16/16a/16b (figs. 1, 10-11) is deposited to about 1000 angstroms (col. 1, lines 55-58).

Re claim 13, wherein the polish stop layer is made of a material (i.e., silicon nitride, col. 1, lines 53-58) that is more slowly polished than insulation material (fig. 6, oxide 28) of the insulation layer.

Re claim 19, wherein during forming an insulation layer that fills the trench, following the formation of the insulation layer to cover the polish stop layer and inner walls of the trench, CMP is performed on the insulation layer until the polish stop layer is exposed (figs. 6-7; col. 2, lines 24-35).

Re claim 20, wherein prior to forming the insulation layer 28 (fig. 6), a liner oxidation layer 24 (see figs. 5 and 10-11) is formed on the trench and the polish stop layer, then the insulation layer is formed on the liner oxidation layer such that the trench is fill with a material forming the insulation layer (i.e. oxide, fig. 6).

Moore et al. disclosed in above; however, Moore is silent to use organic material for anti-reflection coating.

In this regard, using organic material for anti-reflection coating has been known in the art for reducing light scattering back into the photoresist, etc. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

"Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

Bamnlker et al. teaches a method for forming semiconductor device, which comprises using either organic or inorganic material for anti-reflection coating 32 (fig. 6, col. 4, lines 1-25); Bamnlker et al. further teaches using the pressure environment of about 10 mTorr (see table 1) during etching the polish stop layer 30 and the semiconductor substrate 26, see figs. 1-7 and cols. 1-12 for more details.

Therefore, the subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to use either organic or inorganic material for the ARC and using the pressure range as taught by Bamnlker et al. in the method of Moore et al. (i.e., replace layer 70 or 16a/16b with organic ARC) in order to form the trench that reduces

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light scattering back into the photoresist, minimizes standing wave effects, etc. Further in this regard, the specification contains no disclosure of either the critical nature of the claimed process/arrangement (i.e. –using organic material for ARC) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the Applicant must show that the chosen limitations are critical. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990).

Furthermore, with respect to claims 5, 11 and 18, the claimed ranges of pressure in the etching step, absent evidence of disclosure of criticality for the range giving unexpected results are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as pressure, temperature and concentration would have been obvious. *See also In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Note: although Applicant has admitted that the etching chemistry as recited in claims 2-4, 8-10 and 15-17 are well-known in the art, but one can not rely on the well-know facts in order to change the scope of the instant invention.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack Chen whose telephone number is (571)272-1689. The examiner can normally be reached on Monday-Friday (9:00am-6:30pm) alternate Monday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead can be reached on (571)272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Jack Chen
Primary Examiner
Art Unit 2813

June 25, 2006